

## **Mushroom Upgrade: Big Benefits for Human Biomes and Natural Ecosystems – Paul Stamets & Julian Mitchell – #946**

Dave Asprey:

You're listening to The Human Upgrade with Dave Asprey.

Dave:

The guest today, he's a speaker author, mycologist, medical researcher, and entrepreneur, and considered an intellectual and industry leader in habitat using mushrooms as medicine and producing fungi and consider himself a mycological warrior after 40 years plus in the Pacific Northwest and

He's been studying and researching the world of mushrooms. He's come to believe that habitats have immune systems just like we do in our guts and that mushrooms are the cellular bridge between people and the environment. He believes that our close relationship to fungi can be the basis for novel pairings in the microbiome that lead to better sustainability in the environment and better immune systems for us. He's changing paradigms around the world, definitely a game changer. Paul, welcome to the show.

Paul Stamets:

Well, thank you very much. I'm so honored to be here, Dave.

Dave:

Julian Mitchell is CEO and physiotherapy, elite sports physiotherapists with high performance people at the English Premier Club. You traveled around with basically soccer or football, depending on what country you're in, players, and now you're a mushroom guy. Transitioned from sports in the UK to mushrooms, how the heck does that happen?

Julian Mitchell:

I try to explain that it's a natural progression or a natural revolution, but it's definitely not. I guess my roots were growing up in the country in farming and agriculture, but understanding high performance comes alongside nutrition and understanding what tools we have in those nutritional realms. Coming across mushrooms is like you said earlier, there's so many applications that they have and so many properties that they can achieve for the desired outcomes of athletes, as well as everyday people. So that was, I guess, one reason why we got into mushrooms.

Paul:

Fungi came to land first. I've been stating this for years, over 500 million years ago, fungi were the first organisms to come to land. Just this past month, they found a new fossil records that pushes back the entrance of fungi under land to a billion years ago. This is a hundreds of millions of years before plants. And so, these truly are terraforms and they are microterraforming habitats. As the mycelium, the fine threads, go under rocks and munch rocks, then plants then can follow and take advantage of those minerals. With the mycorrhizal fungi, the plants give the fungi all sorts of sugars and the fungi harvest growth-limiting minerals to the plants. And so, the photosynthetic cycles then can spin up.

There's so much of what's been known folklorically that is now being discovered to be scientifically valid. A really simple one and one that I heard from indigenous peoples and my European ancestors have this in their folklore, when lightning strikes mushrooms come up. Also, that's kind of a cute thing, like out on the plains, lightning strikes and brings rains and things like that. Well, group of

Japanese researchers found out that if they grow nameko mushrooms and shiitake mushrooms on logs and they zap it with 50,000 volts of electricity, it substantially, in some cases, doubles the yield of mushrooms.

Paul:

If they grow nameko mushrooms and shiitake mushrooms on logs and they zap it with 50,000 volts of electricity, it substantially, in some cases, doubles the yield of mushrooms. You have to think now, indigenous people had this and it's really interesting to me when you have different groups of indigenous people, geographically separated all come to the same opinion.

Dave:

Yes.

Paul:

Myth are based on things that are factually accurate, and that's what I see now science is converging because I'm not religious, but I'm spiritual. I see that science and spirituality are now merging into a greater state of awareness. What astronomer is not amazed by the enormity of the universe that we're now able to decipher and document. It's increasingly such an extraordinary tale of how small we are and how vast the universe is.

It makes our uniqueness... Well, it's still an egocentric. We think we're so unique, but I believe that matter gets life. Life becomes single cells. Single cells becomes strings, strings fork. That's mycelium. And that the way of matter is to create multi-cellular organisms. The multi-cellular organisms are based on networks. The first networks will be that of fungal mycelium, and mycelium gave birth to animals 650 million years ago. You and I are actually mycelial beings and we are descendant of fungi. Fungi are our ancestors. When you see mushrooms and they're out in the woods, these are ancient elders that have their forms tens of millions, if not hundreds of millions of years ago. These are not just a recent appearance like Homo sapiens the 200,002 million years ago. These mushrooms predate us and their forms hundreds of millions of years prior to us, in some cases, tens of millions of years.

Dave:

Where do you see the future 20 years from now in terms of percentage of human diet from mushrooms versus algae versus some sort of cultured cellular product thing versus "real food" from soil?

Julian:

First point is that mushrooms and mushroom-based foods are going to play a huge role in the future of food. As they grow quickly, they require very little resources in terms of water, power, and land and the amazing nutritional profile that they have, and of course, being 100% natural. As for the algae industry and algae, well, actually our biotechnology engineer previously worked in this industry in Europe and moved across to mushrooms largely because the adoption was going to be very slow due to its high energy inputs, its enormous use of water, and limited applications due to its high unit economics and costs. And so, less optimistic on algae and the future there. But cellular-based meats, I guess there's a couple of questions around what are the key ingredients, how many ingredients are being used, preservatives and numbers. Are these ingredients GMO? So these are important questions, I guess, that come alongside cellular-based foods.

And then we have seen some great plant-based meat companies. While being very good for the planet, the real question, I guess, is what are those ingredients and other inflammatory markers within those ingredients. But I think it's safe to say soil-based foods, regenerative farming should take up to 65% of our plate, grass-fed, permaculture-raised animal protein sources, somewhere around 15%, same with mushrooms being somewhere around 15% and cellular-based foods, somewhere around 5%. I think that kind of diet attached to asking the important questions. Where was our food growing? How was it growing? This sets us up for a bright future of food and a healthier society.

Dave:

I know that when we run additional electricity over our brains, and I do this at my neuroscience institute in Seattle, and I've done this for 20 years, you run a little bit more current over your brain and it causes neurogenesis. It raises BDNF. The same way that taking certain kinds of mushrooms, like the lion's mane that you make, right? We know that it does something. So, is it your supposition there that inside our bodies, some of our cells are fungal in origin?

Paul:

Oh, absolutely. I mean, we're coding for the same compounds. Serotonin is very common and tryptamines and these precursor compounds, even tryptophans are resonant throughout nature. I always thought that really good graduate thesis, which someone probably has done, but is one that I wanted to do way back 20 years ago is a dimethyltryptamine pathways in nature. Psilocybin is a form of DMT. If you track those dimethyltryptamine pathways, you would see that all nature is connected. There's a universality of biomolecular bridges using tryptamines that permeates all of nature, and that speaks to me of a nature consciousness that nature is aware. Really, we're still Neanderthals with nuclear weapons. We really have not waken up to the enormity of our presence and the miracle of our existence, but because of our prefrontal cortex and the drive for survival, it's almost like we were conditioned to have a very utilitarian and impractical skill set in order to achieve the level that we have now, where we can go full circle to embrace the mother that gave us birth.

Dave:

So given that most plants make defense compounds to keep animals from eating, this is why grains are bad for you, nightshades generally are bad for most people, how do you know that all these species that we're using are actually completely safe for humans versus, "Oh, they're mostly good, but they have these gnarly downsides on them"?

Julian:

Well, at Life Cykel, our process for deciding what mushrooms we grow and put into our product starts firstly with a detailed scientific literature review, toxicology evaluations and laboratory tests to get the data on DNA identification, heavy metals, microbiology, and mycotoxin testing. And so, I guess, as a listener, hearing that medicinal mushrooms and functional mushrooms play a role, maybe a new concept, but really there are 30,000 scientific medical articles out there in the reviews. This gives us a lot of science to work from. And so, I guess it's important to realize the vastness of the fungi kingdom with mushrooms at numbering plants six to one. So this means just like there are medicinal and harmful plants, the same goes for mushrooms. As general rules and theoretically, not consuming raw mushrooms is a very good idea. And then secondly, functional mushrooms such as turkey tail, which we know possess high amounts of PSP, which is polysaccharide peptide, which acts to support the growth

and proliferation of good bacteria, it makes sense to incorporate these into maintaining and restoring good gut health.

Dave:

I've also seen more recent studies around specific subspecies. In fact, cordyceps, I believe, is one of them that actually have anti-candida properties. So the deal is you should know what mushroom you're using and what you're using it for. If you're a long-time listener, you might just say, "Oh, Dave doesn't like mushrooms." No, I've always said use them medicinally and I'm amending that to say, use them for food if they make you feel good and your food is your medicine anyway.

So if you can eat something that tastes good, that also increases ergothioneine levels, you may feel a kick from it right then. You probably won't from eating half a cup of cooked mushrooms. But if you take a tincture, you probably will. Because I've noticed very, very profound effects from the tinctures that you guys make and I did test them against a bunch of others. At least when I look at my sleep score, I get a lot more REM sleep with the specific strains of lion's mane in particular that you make. I know a group of people who are convinced that they're going to deal with their traumas or achieving enlightenment or something through frequent, multiple times a week or once a week, use of mushrooms or ayahuasca or ibogaine or any of these other things like that. Is there such a thing as too much psilocybin?

Dave:

Is there such a thing as too much psilocybin?

Paul:

I've never been asked that question, but from my experiences and the reason why psilocybin mushrooms are so interesting to psychotherapists, psychologists and even the FDA is that they're non-addictive.

Dave:

They're non-addictive. Yeah.

Paul:

You have a massive dose of psilocybin mushrooms. You're on the ground. You're seeing God. You've connected with nature. The next day, you look at those mushrooms, you go, "No friggging way am I eating those again."

Dave:

How could you do them every day?

Paul:

I'm not eating those for a month. So I think that gut response also the microbiome is important, most of your receptors in your gut for a neurogenesis. You feel queasy right after you eat mushrooms. I think the microbiome is waking up to all of that. I would say microdosing, I don't see the frequent use of psilocybin mushrooms microdosing. Microdosing is defined basically as 1/10 or 1/20 of a liftoff dose.

Dave:

Okay. So it's a very different vector. That's more-

Paul:

That's a bit more like a vitamin.

Dave:

From neurogenesis growing neurons in the brain, as well as for the gut bacteria, you're saying.

Paul:

Right.

Dave:

Are there other fatty mushrooms?

Julian:

Well, lion's mane is the fattiest mushroom of them all with five grams out of a hundred grams of dried mushroom being unsaturated fat for the most part. And so, really though, the key nutrients for functional mushrooms, such as your lion's mane, your reishi, cordyceps, turkey tail are the amino acids, the beta-glucans, the dried terpenoids and the antioxidants.

Dave:

What about fats? Is there like a butter mushroom that grows fat inside it? I want that.

Julian:

A butter mushroom? Well, there are thousands of mushrooms out there yet to be identified, but we are not aware of a butter mushroom, even though we are commonly foraging on the weekends. We haven't come across this one though, as we know if we had some grass-fed butter or some Bulletproof MCT oil to mushrooms in the pan that makes for a pretty delicious meal.

Dave:

You guys do some other weird stuff that may be why I get a stronger response from your alcohol-based extracts. You use something called Kakadu plum that I was entirely unfamiliar with. This is a native heritage food from the Aboriginal people of Australia. I knew nothing about this. So, what is it?

Julian:

Kakadu plum is an incredible fruit that is wild harvested by indigenous Australian communities and remote areas of the Outback. So it's been shown to have the highest amount of vitamin C of any fruit in the world, a hundred times an orange. And so, it's very rich and rare, carrying amazing properties, including antiviral and antioxidants. And so, by mixing it with the mushrooms, we've found it definitely heightens and amplifies the benefits of the mushrooms, particularly lion's mane, as you've mentioned yourself.

Now, we are incredibly grateful for the special friendships and partnerships we've been able to form with community and special mention to Gumbra, an amazing man, a Dreamtime leader from the Wakka Wakka community, who introduced us to the healing and ceremonial ways in which this is consumed in Australia. And so, all of our liquid extracts and powders have this amazing Kakadu plum infused through the mushrooms, as well as our golden mushroom chia. We're really getting some great testimonials about dreaming, REM levels. But also because of its vitamin C content, what we're finding is that it helps your body recover, building immunity, which means you have more energy and your body's less under trauma.

Paul:

There's a great study that came out, randomized placebo double-blind controlled study on turkey tail mushrooms, the mushroom mycelium, showing that it enhances the activity of Lactobacillus acidophils and Bifidobacterium.

Dave:

It's a prebiotic.

Paul:

Yeah, it's a prebiotic.

Dave:

Okay.

Paul:

And stifles Clostridium, Staphylococcus.

So this makes a lot of sense to me because most people love mushrooms, but about two to 5% of the population, they don't like mushrooms. It makes them feel queasy. They don't like them. I realize now that's actually a scientific observation. It may be their microbiome is incompatible with the mushrooms that's a prebiotic, the majority of us, the umami effect of the flavor-enhancing, et cetera. Actually, your microbiome is like, "Yes, this helps me achieve a better homeostasis and health," but some people are mismatched. And so, that mismatching may be the case. Now, with psilocybin much of taking on high doses several times a week, I don't see it. I think you need to reset. I think you have to re-normalize. You need to wash your receptors and then stimulate them again, but I think it's like the tide of the-

Dave:

Cyclical.

Paul:

... water washing onto the land. That washing and then retreating and then resetting, I think it makes the experience continually novel and fresher. I think that stimulation, pause, stimulation, I just know from lots of other work that I've done, that pulse therapy is much more effective.

Dave:

Everything, for diet, for exercise, for fasting, it doesn't matter. If it's not cyclical, it probably doesn't work well.

Paul:

Yeah.

Dave:

What does the research show about what happens when people eat oyster mushrooms?

Julian:

There are a number of different types of oyster mushrooms, such as the pearl, the king, the blue, the pink and the yellow and we grow all of these in Australia at our farms. They'll have great compounds and nutrients from B vitamins, folic acid, calcium, iron, zinc and potassium. Probably two amazing data points that are of most interest is one around the amazing antioxidant ergothioneine. Ergothioneine is involved in the protection of mitochondrial DNA and chronic inflammation. So this, I guess, really lends itself to being a great mushroom as part of an anti-aging strategy as it protects using its antioxidant profile.

The second one would really be focusing on something called shikimic acid, which there was a great study out of the university in Japan in 2014 that showed by growing oyster mushroom, mycelium in mushrooms under blue light increased the expression of shikimic acid by 200 fold. Why that's important is because it helps inhibit the enzyme for influenza A and B viruses, which are responsible for the flu. So eating oyster mushrooms that are growing this way is a great strategy for staying healthy in winter and preventing those cold and flus.

Dave:

Now, how can you take oyster mushrooms? You can eat them. Is this appropriate for a powder or a tincture?

Julian:

You can make them into tinctures. Absolutely. I guess they are a delicious mushroom. So it's like some of the other mushrooms such as the reishi or the turkey tail, which are inedible because they've got what's called chitin in them so they're very tough and fibrous. They're not able to be cooked down. So the oysters can be put into risottos, into breakfast dishes, into soups or broths, or a great side to some vegetables and some grass-fed steak or meat. And so, they are a delicious mushroom to consume, but they can be in a tincture, as well they can be in other powdered forms.

Dave:

Just to define that word for people who really probably haven't dug in on it, tincture, what is a tincture? What are the ways of making a tincture and what are the pros and cons?

Julian:

Absolutely. Tinctures, in our case, we make a double extract, which is a water ethanol extract. So that's the process where we're extracting the medicinal compounds using water and ethanol as the process. And so, by doing the tincture process with water and ethanol, you're getting all the medicinal compounds, the beta-glucans, as you mentioned, the polysaccharides, the triterpenoids, the terpenes,

all these long-winded names that are essentially the medicinal compounds come from that extract, but in a liquid form, it's more bioavailable than in a powder form. And so that's why we're big believers of that and very passionate about making high quality tinctures. Just as you mentioned previously about the kombucha space, kombucha comes onto the market. There's some high quality products there. And then the market gets flooded within a whole range of products and the quality goes down. And so, it's really a matter of keeping the quality high so people are getting those effects.

Dave:

If you're listening to this, you go, "Oh, tincture, that sounds hard." No, you make a tincture every morning. It's called coffee. It's a water. It's a hot water extract of Arabica coffee beans, at least if you're drinking good coffee. It might be robust otherwise. So tinctures are nothing new. Tea? Tea is a tincture,

Paul:

I authenticated that the diluted extracts of mycelium, the water and ethanol, had extremely potent antiviral activities far exceeding that of pharmaceuticals.

Dave:

Wow.

Paul:

A natural product offers a stronger effects than a pure pharmaceutical, in this case, compared to ribavirin and cidofovir. These are two well-known antiviral drugs. So side-by-side comparisons blew them out the water. It was diluted. These extracts are diluted a hundred to one because they're on 35% ethanol and either in vitro human cell wall assays in laboratories sponsored by the U.S. government. So they have to dilute the alcohol down to 0.35%

Dave:

So as to kills the cell.

Paul:

Yeah, it's a hundred to one dilution. A hundred to one dilution, we beat these antiviral-positive drug controls.

Dave:

You basically soak the mushrooms in alcohol, pour off the alcohol, I'm simplifying it, filter it a little bit, cut it with water by a hundred.

Paul:

It's the mycelium. It's the mycelium.

Dave:

Yeah. So not the mushroom, the mushroom roots. How do you even gather mycelium versus the [inaudible 00:24:03]? You dig them up? How do you filter the soil?

Paul:

Extensive laboratories.

Dave:

Okay. Got it. You have a lab that does that, right?

Paul:

Yeah.

Dave:

I got it.

Paul:

Laboratories, you got in vitro. It's in my books, Growing Gourmet and Medicinal Mushrooms.

Dave:

Sure. Yeah.

Paul:

Anyone listening can look up the books. So you all can do this yourselves. I mean, this is not...

Dave:

Making mushroom in effect is easy.

Paul:

I was going to say it's not rocket science, but there is some heavy science involved. But like anything else, once you do it a few dozen times you get pretty good at it. So, I actually had a waking dream.

Dave:

Wow.

Paul:

I had this idea. So oh my God, I wonder if these extracts using the Bioshield, Biodefense program can help the bees because the Varroa mites are vectoring viruses and the deformed wing virus is the most harmful of the viruses. So like having a pancake on your back, these mites are that big.

Paul:

The Varroa mite is called Varroa destructor because it destroys the... Once a beehive has 7% mite infestation, that is terminal. That beehives won't survive. Now, we tested about 10 species. Five of these polypores have demonstratively positive effects in reducing these viruses. There seems to be species specificity factors. Very interesting. Certain species of these polypore mushrooms are more active against certain species of virus.

There's the Israeli AP area virus. There's the deformed wing virus. There's the Varroa destructive virus. So the different clades of viruses, but we were able to first through PCR showed all the viruses that were harmful reduced by 90%. And then we look at specific viruses and then we reduce the deformed wing virus, 850 or something to one, Lake Sinai virus, 4,500 to one, all the one treatment. So, this is amazing because now I can make the argument. This is really important that natural products can offer a greater Bioshield of benefits than a pure pharmaceutical. We showed it with the Bioshield program. Now, we're showing with bees. Now, the bee study, this is an animal clinical study. Bees are the second most of all studied animal in the world, humans being No. 1, but everybody missed this and we all grew up with the Winnie the Pooh.

Dave:

Right.

Paul:

We all knew that bears went into rotted logs where there bees to get honey. And so, this is the way of nature. You follow the mycelial path. You then come into a mutualism with fungi and there are armamentarium of benefits when you want you in their guild, in the fungal guild. Now, you have partners with bacteria that are helping you, fungi that are helping you.

Dave:

Wow. Talk to me about chaga.

Julian:

Chaga is a fascinating one from a scientific point of view. We refer to it as a sclerotia, not a mushroom, as it is actually a compact mass of mycelium growing on the outside of a tree. And so, this grows wild in climates of Russia, Northern Canada, parts of the U.S. and China, typically growing on birch trees over five to 15-year periods. And so, we don't have access to this in Australia. In terms of its properties, it's well known for activating B cells and macrophages. And so, these play a major role in an adaptive immune system by secreting antibodies. Secondary to this, it also secretes metabolites, which have potent antioxidant properties, such as polysaccharide and triterpenoids. This has been proven to provide and protect cells against oxidative stress.

Dave:

So what's the deal with lion's mane? Can you eat it? How's it best taken? What does it do?

Julian:

It's known as lobster of the woods, but it's by far a very popular mushroom for its benefits for the fact that it stimulates nerve growth factor. And so, nerve growth factor stimulates myelin reproduction. Myelin is what's around our nerve cells and our neurons. And so, as we're getting older, which occurs

from pretty much our early 20s, we're starting to... To cut the case slowly, it helps re-myelinate the nerve cell and the nerve sheath. And so, what does that mean? Well, in our elderly population or more aging population, it's where did I put my keys? What was I doing? What was on my checklist? It's just that mental sharpness and clarity starts to fade. In the younger population, it's really around memory focus, concentration, optimum performance is what we're seeing. And so, you take it either in the morning or in the evening. It will affect your REM and your dreaming and it will also increase your ability to just find clarity on a mental space and focus.

Dave:

Talk to me about how to cook mushrooms. What's the best way to cook them so that I get all my bioactives?

Julian:

First of all, make sure you are consuming them cooked, not raw. This way you are breaking down the skin of the mushroom known as cotton to avoid any digestive issues or discomfort. Secondly, cooking the mushrooms also kills the unwanted spores and compounds. When cooking, say, the oysters or the shiitake, to maximize your ergothioneine, it's important to preheat the pan, add some water, and then cook on a high flame for a couple of minutes.

Dave:

Do some of the compounds in mushrooms benefit from being cooked or eaten with fat, or are these mostly water soluble and alcohol soluble, doesn't matter?

Julian:

There's extracts that we make our water and ethanol soluble so you can go down other path.

Dave:

But I'm talking in terms of cooking.

Julian:

In terms of cooking, what compounds are you going to consume or make more bioavailable? So if you're cooking in a fat, then you are going down the path of a fat-soluble extract, which means you're going to get your triterpenoids and your terpenes. Whereas if you go down a water-soluble cooking path, then your beta-glucans, your polysaccharides is what's going to be more bioavailable to you.

Dave:

So that means I'll keep cooking my mushrooms and I won't cook them on low temperature. So sous vide mushrooms, not a good idea.

Julian:

Not a low temperature and not raw.

Dave:

All right.

Julian:

They're the takeaways.

Dave:

You've almost certainly read the Secret Life of Trees. The Secret Life of Trees talks about a network effect in forests that is unbelievable.

Paul:

Deciduous trees growing in the rivers will translocate nutrients up, I think, to 14% nutrients to trees like hemlocks that are nurse logs in the old-growth forest.

Paul:

It was always wondered, how is it those small trees survive in the dark and the low-light conditions of the old-growth forest? And so, they radioactively tagged and they found nitrogen and carbon being transferred from deciduous trees to conifer trees over hundreds of feet.

Paul:

So the mycelium was actually having a mothering influence to projecting biodiversity of the ecosystem.

Dave:

It was growing the forest. Paul, it's been a profound pleasure to have you on. I've got a final question for you. How long are you going to live given what you know about mushrooms?

Paul:

I don't know how long I'm going to live, but I do feel that the impact that we have on future generations and I feel the keen sense truly of future generations calling back in time, calling to you, Dave, calling to me, calling to all of us listening, that we have an enormous influence on the future and it is time for us to take up that responsibility and to think downstream.

Dave:

What a fantastic and unexpected answer. Paul Stamets, founder of Host Defense, Perfect Fungi, but your big thing right now is BeeMushroomed.com.

Paul:

BeeMushroomed.com. I will do this to the limits of my ability. We decided to open it for the commons. I will commercialize only in order to create a financial vehicle to be able to give it away. You have to be profitable to be charitable.

Dave:

Yep.

Paul:

I have to create the revenue stream to be able to afford to do this.

Dave:

It's self-sustaining.

Paul:

I can't distribute a hundred million bee feeders. That's what it's going to take to save the bees is my of estimate, a hundred million bee feeders, a hundred million citizen scientists all over the world uploading their data, sharing observations, and proving it.

Dave:

Well, that whole feeding your kids and your grandkids because we have pollinators out there seems pretty important. So I'm behind you and I'll put this up in the show notes.

Paul:

All right. Thank you so much. All right, Dave.

Julian:

The future will largely be determined by biotechnology. And if we keep the greater good in mind and strive to reach our full potential, that means working symbiotically with mushrooms.

Dave:

Thanks for making stuff that works— Have a wonderful day. If you like this episode, you know what to do, try some mushrooms already.